

# TPWKY - EP 200 - Poop Part 1

**Poop 1 Firsthand:** [00:00:00] Hello. My story about poop is an embarrassing one and one I am comfortable to share, but one that is embarrassing and like a lot of embarrassing stories. It happened when I was much younger. I was in fifth grade at my first experience of staying. Away from my parents with my school class. It was at an outdoor ed adventure in the woods where you do ropes courses and team building exercises and you stay in a cabin. I remember being excited for it. I remember having good friends in elementary school and I remember the first day going rather well where we were in the woods playing outside. The first night was a large like sort of cafeteria style lunch where we had, I don't remember what the food was, but I sat with my friends. Everything was rather normal. And then we took a long walk to, there was a planetarium attached to this outdoor ed facility, and we were gonna see a late night, probably like eight or nine o'clock planetarium show. And I remember walking with my friends talking, and the it, my memory is a little fuzzy at this point, possibly for reasons to protect myself.

But at a certain point during this walk, I think I attempted to fart and poop came out. And then, uh, poop continued to come out. And at a certain point. I don't know what happened in my brain, but I was okay with continuing to let poop come out because there was really nothing I could do. I was committed to going to the planetarium. I was committed to seeing this through, and I, and I truly didn't know what else to do, and I'd already done the poop and I thought it was done. So every time a new wave of having to go to the bathroom came to me, I let it happen. And I remember walking with a lot of poop in my pants. My, my pants were jeans. They were like tough denim jeans. And the poop was like, I would describe it as like tooth pasting down my leg. It was really horrible. But again, I wasn't like. Super disturbed by it in the moment we went to the planetarium. I sat next to my friends, I promise, I think I continued pooping. I remember people smelling it. I remember successfully just saying it wasn't me. And, and saying that I smelled it too. And then I remember walking back to our cabin, immediately going to the shower, taking off my pants in the shower, attempting to clean my pants so that I could put them, you know, in a bag that I could take home with myself. I remember that shower being possibly, at least up until that point, the greatest shower of my entire life. And, um, that is the end of the story. I did put myself again the next day. I mean, it wasn't as obscene or abundant, but it happened again. And I don't know if it was nerves, if it was something about the diet, but that is my poop story and I am not proud of it. I think my life would be very different. Had my friends found out, and most of them still don't know. But anyway, that's my story.

**EW:** Thank you so much for billing so much, being willing to share that. Ah, hi, I'm Erin Welsh.

**EAU:** And I'm Erin Allmann Updyke.

**EW:** And this is, This Podcast Will Kill You.

**EAU:** Welcome to Poop.

**EW:** Poop. Poop. Poop. Yeah.

**EAU:** Part one,

**EW:** I think we decided to do an episode or two episodes about poop, two episodes without really knowing what they were gonna be about and we're just like, poop. That sounds like something we would talk about,

**EAU:** like

**EW:** it is

**EAU:** on, on for on end. Like continue to talk about.

**EW:** Yeah, yeah,

**EAU:** yeah.

**EW:** Um, but we are going to, we eventually were like, okay, I guess we'll have to come up with topics, right? Specific to poop. What do people wanna know about poop And, yeah.

**EAU:** And so here we are now.

**EW:** So here we are. So this episode we're gonna be talking about what is in poop,

**EAU:** right?

**EW:** How we make poop.

**EAU:** Mm-hmm.

**EW:** And, uh, I'm gonna go [00:05:00] into a little bit of like, poop in the animal kingdom.

**EAU:** I'm so excited. And not just like how animals poop, but like all of the ways in which we can use poop.

**EW:** Yes.

**EAU:** I'm

**EW:** excited. Yeah. Poop is a resource. Is is how I had originally titled this Will, the second episode was just like, poop is gross.

**EAU:** Poop is gross.

**EW:** Yeah. Uh, so, and next week we're gonna go into, yeah. More of poop is gross. And then what happens when you can't poop the way that you should poop.

**EAU:** That's

**EW:** what I'll

**EAU:** talk about.

**EW:** Yeah. And I'll talk about like toilets, the history of sanitation, just how disgusting ancient Rome really was.

**EAU:** Cannot tell you how excited I am to hear about how disgusting ancient realm was.

**EW:** Well, I wanna hear more about fiber and peristalsis. I'll

**EAU:** tell you about it. Great. I'm not gonna tell you that much about peristalsis.

**EW:** I just like the word Eric. It's

**EAU:** a great word.

**EW:** Just wanted to be able to say it.

**EAU:** We'll say it multiple times.

**EW:** Um, oh, poop quarantine time.

**EAU:** We have that, actually. We do

**EW:** have that. I completely forgot. Me too. It's been a while since we've like, recorded, recorded.

**EAU:** It's been a minute.

**EW:** Um, what are we drinking this week?

**EAU:** We're drinking drink number two,

**EW:** drink number two.

**EAU:** Of all the ways that you can say poop. We found that one to be the most charming.

**EW:** I really do. I really do like it.

**EAU:** It's good.

**EW:** It's a good one.

**EAU:** It's also a delicious drink.

**EW:** It is. What is in poop? Oh, sorry. What is in drink number two? Not poop. Number two.

**EAU:** I'll tell you that later. But what's in drink number two is basically a a like a mint chocolate martini situation. Yes. So there's vodka, there's creme cacao or something similar to that. Chocolate la cour chocolate la cour

**EW:** peppermint schnapps.

**EAU:** You can tell I don't make the drinks.

**EW:** Some chocolate syrup, you know? Delicious. Be delicious.

**EAU:** All.

**EW:** Done. We'll post that on social media. We'll, at least,

**EAU:** at least

**EW:** possibly website, if we can get around to it.

**EAU:** We're still working on that. Honestly. It's been a struggle.

**EW:** You know, it's fine.

**EAU:** You just have to follow us on socials.

**EW:** Yes, please do.

**EAU:** And then you'll see it there.

**EW:** And also also on YouTube.

**EAU:** On YouTube, because we're here in the Exactly right studio

**EW:** we're, yay. Yay. It's um, really fun to be here again. And if you would like to experience some of that joy with us mm-hmm. Please go to [youtube.com](https://www.youtube.com). The exactly right. Media channel. Exactly right. And you'll find us.

**EAU:** And we're there. Follow us.

**EW:** Yeah.

**EAU:** This whole season has been on YouTube.

**EW:** It has been.

**EAU:** So it's been quite exciting

**EW:** with some occasional, really fun videos and pictures.

**EAU:** We have a couple for you today.

**EW:** We do

**EAU:** All right. With some props.

**EW:** With some props.

**EAU:** Um, also business. Last piece. We swear we're almost done here. Oh, website.

**EW:** Yeah,

**EAU:** we do have a website.

**EW:** Yeah.

**EAU:** It's true. This podcast will kill you.com. Uh, we have a lot of things there. You can find all of the sources from this episode and all of our episodes. You can find links to our bookshop.org affiliated account and our Good Reads list. And merch. Merch. Ooh, merch. Um, you can also find transcripts. Transcripts, yep. And blood mobile. Who does all of our music?

**EW:** Yep.

**EAU:** Firsthand

**EW:** Account

**EAU:** form, firsthand account form.

**EW:** Contact us form.

**EAU:** There's a lot there.

**EW:** There's lots.

**EAU:** Check it out.

**EW:** Okay. Are we finally ready for number two?

**EAU:** I think so, Erin. Okay. Okay. We'll take a break and get started. Poop. Sorry. It's every time I say the word poop, it makes me laugh still. I

**EW:** know, I know.

**EAU:** Poop is the non-digestible parts of our food.

**EW:** Yes.

**EAU:** Mixed up with a bunch of digestive juices, mucus left off cells from our GI tract, and of course tons of bacteria, both living and dead.

**EW:** What is, what do you mean by tons?

**EAU:** Oh, I'll tell you.

**EW:** Okay.

**EAU:** Just you wait. So I thought that for the start of this episode and this series, really where we're gonna be talking so much about poop, it feels important and also fun for me, uh, to go through the process of digestion and learn how we make a poop together.

**EW:** How we make a poop together,

**EAU:** learn together how we make a poop.

**EW:** Okay. I, I prefer that. Yes.

**EAU:** Um. Miss Frizzle did this on a lovely journey through Arthur's digestive tract.

**EW:** I still remember this.

**EAU:** Same, uh, so we're basically going to take Miss Frizzle's journey,

**EW:** love this

**EAU:** through our own digestive tract.

**EW:** Great.

**EAU:** Uh, along this journey, we might mention a lot of places where things could go wrong. I'm not gonna get super into detail on the things that could go wrong Okay. Right now. But if you have questions, I know you'll ask them.

**EW:** You know, I will.

**EAU:** No qualms about that.

**EW:** No.

**EAU:** Uh, but mostly I'm gonna be talking about like the process of digestion. How we make a poop so that we know really what is in our poop. And then next week is when we'll talk more about how things can go wrong with a digestion and poop.

**EW:** Poop problems.

**EAU:** Manufacturing. Yeah.

**EW:** Manufacturing, food. Manufacturing. LTD.

**EAU:** So [00:10:00] digestion starts in our mouth as soon as we put a bite of food into our mouth. We've got amazes and other enzymes in our saliva that start the process of breaking down the like complex starches in in that's in our food. And of course, our teeth are grinding and breaking things down into teeny tiny pieces. As we swallow that food matter will pass through our esophagus aided by these muscular contractions that you love so much that we call peristalsis

**EW:** peristalsis,

**EAU:** as well as aided by all of that saliva that we mixed our food up with. And then our esophagus has to travel all the way, like from our mouth, basically down through a hole in our diaphragm, which is that muscle that separates our chest from our abdomen.

**EW:** Mm-hmm.

**EAU:** Through a hole in that diaphragm and then through a sphincter called the lower esophageal sphincter. Sphincters are a recurring theme.

**EW:** Oh yeah.

**EAU:** They're attract.

**EW:** They are essential.

**EAU:** Exactly.

**EW:** Yeah,

**EAU:** very much so. And are. Food bolus, which is what it's called at this point, will land with a splash. I like to imagine, uh, in the digestive acids of our stomach.

**EW:** Okay. So it's like a sea of acids?

**EAU:** A little sea. It's probably not realistically, but it's the way I like to imagine it.

**EW:** Okay. Okay.

**EAU:** Okay. And our stomach is up in the upper left hand side of our belly.

**EW:** Got it.

**EAU:** Okay. And there in our stomach it will churn literally with muscular contractions and burn literally with hydrochloric acid, as well as other enzymes that our stomach makes, like Pepin and other things to further break down our food and create this kind of like liquidy, mushy mass that's called chime. Chime, chime and our stomach. Then lets that chime out a little bit at a time through yet another sphincter called the pyloric sphincter.

**EW:** How little at a time? What, what do you, what do you mean?

**EAU:** It's a great question. So the amount of time, how little, it kind of depends on what it is that you're eating. So, liquids are gonna like

**EW:** a donut that we just

**EAU:** ate, like we just ate. Uh, it usually takes, half of our food will be emptied from our stomach in about an hour or so.

**EW:** Okay.

**EAU:** And then the rest of it, it can really just depend on like how much fat was in it, um, how well we chewed it, because bigger pieces that are larger than like two millimeters cannot pass through that sphincter. So they have to be broken down further

**EW:** Yeah.

**EAU:** Before they can pass through. Um, and all of that just happens in our, in our stomach. So it's doing all of that, but usually between two and four hours, your stomach is completely empty after a meal.

**EW:** Two and four hours. And fat, more fat means longer time digesting.

**EAU:** Exactly, yes. Because it kind of sits on top because it floats. Oh. And so then it like, whatever takes longer for it to kind of end up passing through that sphincter.

**EW:** Right.

**EAU:** And in that way our stomach is a really important regulator of our digestion, right? Mm-hmm. Because it is slowly letting food or time rather out of our stomach, into our small intestine at a rate, ideally, that our small intestine can actually handle it if it just dumped all of the contents at once. That would be miserable and you would feel really sick from it. 'cause your small intestine. Yeah, I feel like really doesn't get enough credit. It's in our GI tract.

**EW:** It's so huge.

**EAU:** It's huge.

**EW:** It's not the, it's not aptly named.

**EAU:** No, it

**EW:** is the long intestine.

**EAU:** It is the long intestine. It is small in diameter and that's why it's called the small intestine. Um, but yes, it is also the place where we are. Doing all almost of the absorption of our nutrients. Like you could take out someone's entire stomach, you could take out someone's entire colon. You really cannot take out their whole small intestine,

**EW:** but you can take out like chunks of it,

**EAU:** even taking out small chunks of it can have pretty significant effects. And ends up with what we call short gut syndrome. Yes. Which can have quite a lot of side effects. So anyways, I just feel like small intestine doesn't get enough cred.

**EW:** How long is the small intestine?

**EAU:** Great question. Anywhere from, let me check my notes because that's later. Three to five meters, which is like nine to 16 plus feet,

**EW:** I mean,

**EAU:** or so long.

**EW:** It's just all coiled up in there, right?

**EAU:** Yeah. Yeah. I want everyone to know that I tried really hard to make like a large diagram. Uh,

**EW:** did you make it to scale like you were gonna have like nine to

**EAU:** 15? Oh no. It was like the size of my child.

**EW:** Okay. The, your child's not nine feet.

**EAU:** No, no, no. Well, neither are we. But it was coiled.

**EW:** Yeah. Oh, oh, I see, I see.

**EAU:** Like

**EW:** I thought you meant

**EAU:** no. Anyways, but I didn't, so I have no visuals right now except my hands. Okay. Where are we, Erin? We've gotten way off course.

**EW:** We started giving credit to the small intestines,

**EAU:** so that's where all of our food, that our stomach lets out. Makes it. Mm-hmm. And in addition to all of the absorption, which is happening in our small intestine, our small intestine is also a place of continued digestion. So our gallbladder, which everyone is an expert on now because we did an episode on gallbladder mm-hmm. As well as our pancreas, are both secreting additional digestive enzymes into our small intestine. They let [00:15:00] them out in the first part of our small intestine.

**EW:** Okay.

**EAU:** And that like finalizes the process of digestion essentially for the most part.

**EW:** So things are digested,

**EAU:** so things are all the way broken down because they have to be broken down all the way into like their singular components. Right. Right. All of our starches and carbohydrates from things like bread have to be broken down into single sugars.

**EW:** Mm-hmm.

**EAU:** Um, our proteins have to be broken down into single amino acids. Fats have to be broken down into fatty acids so that in our small intestine they can be absorbed through that intestinal wall and into our bloodstream so that we can actually use these things.

**EW:** So it's like. Digestion. Extraction. Excretion.

**EAU:** Yeah.

**EW:** Okay.

**EAU:** Yeah. Except the colon does more than excretion. And we'll get there in just one second. Okay. Um, so yeah, so that's our small intestine and what it's doing the whole way down, there's like three different parts that have different names and each of them absorb different things. Um, don't ask me any specifics. Uh, most all of everything is absorbed within the first two thirds. Okay. So that's our duodenum and jejunum, the first parts of our small intestine. Um, and then the last part is called the ileum. Mm-hmm. And there, even though most things have been absorbed by then, a few things are very important to be

absorbed only in that spot. Like B12, huh. Um, as well as our bile salts throwback to our gallbladder episode.

**EW:** It's so interesting why

**EAU:** it's so specialized. Yeah. Each part of our system has a purpose. Um, and then at the end of this 16 ish feet journey, there's yet another sphincter, the ileocecal valve.

**EW:** Okay. I just have to say that all of my, all of my favorite words apparently are digestive

**EAU:** words. Yeah. Sphincter, peristalsis. Duodenum. Duodenum.

**EW:** Yeah. Not it's a word, not sphincter. It was the ileal sequel.

**EAU:** Oh, ileal. Sequel.

**EW:** I mean, sphincter. Iss fine. I

**EAU:** love

**EW:** sphincter. It's like, I would put it up there, but not like, it's not, it's nowhere near duodenum.

**EAU:** Okay. It's a

**EW:** good word. Yeah. Or jejunum. Yeah.

**EAU:** Yeah. These are good words.

**EW:** They're good words.

**EAU:** Um, so at this ileocecal valves is what separates the small intestine from our large intestine, which is also called our colon. And our colon. It, it kind of is the star of the show when it comes to poop because this is where this mushy mass of chime and digested food bits that are left over turns into poop. This happens in our colon.

**EW:** Okay.

**EAU:** Our colon starts down in the right lower right quadrant of our abdomen. Okay. It snakes up. That's called our ascending colon.

**EW:** Oh yeah.

**EAU:** I see. Up towards our liver.

**EW:** Okay. Okay.

**EAU:** It goes across the top of our belly and then it travels down to our lower left quadrant, and then it does a S-curve.

**EW:** Okay. I like that.

**EAU:** Sig colon.

**EW:** I like that. Mm-hmm.

**EAU:** Down and back to our rectum.

**EW:** Okay.

**EAU:** And then it exits our anus

**EW:** yet another sphincter.

**EAU:** Two sphincters, in fact. Oh,

**EW:** what?

**EAU:** Yes, the large intestine is called the large intestine because it's much wider than our small intestine. So it's like, yeah, it's like five to eight centimeters instead of two to four centimeters, but it's not nearly as long. It's like five feet ish, 150 centimeters or so long. One a meter and a half. And the way that we go from this pure liquid chime that's rushing through the water side of our small intestine and into the formed tubes that we think of as turds is because our colon is absorbing all of the water that is left over. Right. Our small intestine does a crap ton of water absorption as well. Oh, water absorption. Um, but our colon, that is the primary function of it. It's resorbing water and electrolytes, especially sodium. Mm-hmm. Because the water follows the

sodium and that is like it's main job. It's absorbing like one to two liters of water per day.

**EW:** Mm-hmm.

**EAU:** It also has a ton of musculature around it. And so it is doing peristalsis to really mix all of those contents to make sure that any other things that didn't get absorbed, things that need further breakdown by. The microbes that live in our colon, which do a really important role in breaking down the last bits of things.

**EW:** And I'm assuming that the, our microbiome, our gut microbiome is very different from one start of the small intestine all the way to the pew, pew, pew end. The

**EAU:** pew, pew end. Absolutely. Yeah. Yes. Every aspect of our GI tract has its own microflora.

**EW:** Love that.

**EAU:** Yes. But yeah, that, and then at the, at the end of that, at the very bottom of this gastrointestinal tract, the last pieces, the rectum and the anus are really, really important. Now, the anal canal, it's only a couple of inches long. Okay. It's super short, but it has, in that two different sphincters, there's the internal sphincter.

**EW:** Mm-hmm.

**EAU:** And the external sphincter. Now the internal anal sphincter is not really under voluntary control.

**EW:** Mm-hmm.

**EAU:** So that's automatically opening and closing. And it does this when your rectum starts to fill with poop. Listen, we're [00:20:00] going there.

**EW:** Oh, we we're there.

**EAU:** It's, we're deep in it. As your rectum starts to fill with poop, this causes your internal anal sphincter to relax,

**EW:** Uhhuh,

**EAU:** to let a little bit of the contents of that rectum into the anal canal.

**EW:** Okay.

**EAU:** Okay. Then there's sensors there. There's like a system where it talks back to your brain through the sensory system in your anal canal. That can tell, is it a pooper, is it a fart?

**EW:** But they can't, I mean, it can't always tell you can't tell as we learn, learn from our firsthand account,

**EAU:** but you sometimes can. And so then you go and have control over that external anal sphincter uhhuh, so that if it senses poop. And you're in a place where you can let it out. Then you relax that external anal sphincter and let her rip.

**EW:** And you, yeah, you poop.

**EAU:** Or you sense that there's poop and you're like, I'm not there yet. And so you can clench that external anal sphincter, which everyone's probably doing right now as they listen. Uh, or you can sense that it's a fart, and you're like, now's the time.

**EW:** Now's the time

**EAU:** release. Okay.

**EW:** And hope you're right

**EAU:** and hope that you're right about it. And that is how we make poop

**EW:** amazing,

**EAU:** isn't it? I just really feel like that journey deserves credit.

**EW:** So there's more peristalsis the, the large. Intestine or the colon is the, the star when it comes to peristalsis,

**EAU:** everything is peristalsis. Everything is persis. Mm-hmm. Because you need it to be able for your food, to even make it to your stomach to begin with. Your stomach has a lot of musculature and it's also contracting, but your colon

just has like a, a different setup of muscles where they have these like transverse muscles that run along the whole colon as well as around.

**EW:** Okay.

**EAU:** So they just do a little different types of contraction to really form those turds.

**EW:** I really wanna ask questions about like, what, when does your stomach hurt? What is actually hurting? But I know that that's probably more next week

**EAU:** and it's so variable. I know. But yes. We'll talk more about that next week.

**EW:** When you have gurgles, where is that happening? Oh, do you mean

**EAU:** mean bo orig me?

**EW:** What, there's a word for that. There's a word for that. I get another really good word. I

**EAU:** know, I know. It's really good. Wow. Bor orig me is the tummy Gs that you get the gas bubbles, like,

**EW:** okay, why does it have a name?

**EAU:** Because it's so good,

**EW:** such a good name. Where does that come from?

**EAU:** I have no clue.

**EW:** Is it a person?

**EAU:** These are questions for you, Erin.

**EW:** I know, I know. I literally, in, in the, one of the episodes, I have a whole thing on etymology. It might be,

**EAU:** is it this one?

**EW:** I think it is this one. Excellent. It's, yeah.

**EAU:** Well, I don't have answers for those questions. Okay. But I do wanna talk a little bit more, um, about the poop that, that we have now formed. Yeah. You asked at the beginning like, how long does it take for us to just empty that stomach? And so that's, you know, again, anywhere from like one to four hours, but this whole process of forming a turd can take such a long time. It's anywhere from like 24 to 72 hours. We're talking like one to three days. And it, or

**EW:** if it's gum, it's five years. It's not, that was a way too big of a laugh for that.

**EAU:** Sorry. But I thought it was quite funny. Um, yeah, no, uh, yeah, but it's, it's hugely variable, which I think is so fascinating because it's not just that it varies person to person, which it does, but it can also vary depending on what you're eating. So fiber,

**EW:** I was just about to say,

**EAU:** which we'll talk more about next week.

**EW:** Okay.

**EAU:** Fiber can significantly increase transit times, meaning that things move quicker through your colon and through your small intestine as well.

**EW:** Okay. Increase transit times as in like

**EAU:** faster, faster, faster. Move through. Yeah. Yeah. Yep, yep. Less traffic.

**EW:** Okay. Okay.

**EAU:** Um, but anyway, the, the main timeframe is like between one to three days.

**EW:** One to three days. And what about other things that changed Transit time?

**EAU:** Uh, fiber is the biggest one that has been studied, but there's also like, there's lots of medications that can slow down transit. Big, huge GLP ones that everyone is on right now, the like Ozempic of the world. That's like one of their

main mechanisms is slowing down, slowing gastric emptying and so they slow your transit time, but lots of other medicines can too.

**EW:** Yeah. Why do like opioids slow down transit time?

**EAU:** Uh, I think because of something about the receptors receptor, they're working on receptor where there's also opioid receptors in your GI tract, but yeah, they can cause pretty substantial constipation. Um, the SSRIs also can affect your gut motility in general. Not necessarily slowing it down, but sometimes, sometimes spinning it up, but just cause more or worried me, just more movement there because of how much serotonin we have in our guts. Um, so there's a lot of different medicines that can do that. And there's also, in addition to a range in like how long it takes you to make your poop, which might affect how often you poop, there's also a huge range in consistency of poops. And for that, we can talk about one of my favorite things in all of medicine to talk about, which is the Bristol stool scale, or the Bristol formed stool scale. Uh, and I think we have an image of it, but you can Google it if you're just listening. It's called the Bristol Stool Chart. [00:25:00] Um, and this was invented in 1990.

**EW:** Yeah. Which feels like it should have been invented in

**EAU:** 19, much longer ago.

**EW:** 10,

**EAU:** right. Exactly. But it wasn't, it was within our lifetimes.

**EW:** Yeah.

**EAU:** Um, and they actually invented this, or they came up with this really as a way to correlate. Stool transit time.

**EW:** Okay.

**EAU:** So it was like the longer that your stool was taking to move through your guts, the harder your poops were going to be.

**EW:** Right?

**EAU:** So a type one stool are described as separate hard lumps, like nuts. So like you're popping out pellets,

**EW:** like rabbit pellets.

**EAU:** Oh.

**EW:** Those,

**EAU:** like these rabbit pellets.

**EW:** I like those rabbit pellets,

**EAU:** which I have a shout out to the San Diego Natural History Museum for letting me borrow their poop.

**EW:** They're, it's not real poop. Just in case anyone is, is concerned that Erin,

**EAU:** but it's really accurate. Fake poop. It's touching. Yeah. So yeah, like hard, hard rabbit pellets is like a type one and then a type seven is just like pure liquid poop, just like completely watery, no pieces type of poop. And an ideal poop mm-hmm. Is considered usually between three and four and sometimes a type five. So you want something

**EW:** sometimes. Is that just like depending on the

**EAU:** person dependence. I see. Really, like what is normal for you might be different than what's normal for someone else.

**EW:** That's interesting. In and of itself.

**EAU:** I know, right. Uh, and also this is a slightly different scale for kiddos who are very prone to constipation, but their scale is a little bit different just to make it easier for kids. 'Cause they have a harder time describing their poop.

**EW:** Okay.

**EAU:** Yeah.

**EW:** Why, why do kids have, is it just they're not eating fiber with that?

**EAU:** Um, I think it's more that they hold. Their poop, especially in toddlers.

**EW:** Okay.

**EAU:** Like, there'll be like volitional stool holding it's called. Yeah. And so they basically are like either afraid to poop in the potty, or it's like too big of a change for them, or they have one bad poop and now they're scared of it. There's like so many things that can go into it.

**EW:** So it's like typically during like the potty training stage, potty training,

**EAU:** but then once constant, we'll talk more about this next week parent.

**EW:** Okay. Sorry. Sorry.

**EAU:** But once constipation starts, it's really hard. Like it's a, it's a vicious cycle.

**EW:** Oh

**EAU:** yeah. It's a hard, it's a hard thing to break. Okay. Next week. Okay. Got, I wanted to ask questions.

**EW:** I know. Next,

**EAU:** next, next week. Okay. Uh, but that, I mean, that's like how we make poop. These are the ways that our poop can look

**EW:** Yeah.

**EAU:** Really varied. Um, I don't know what other questions that you have about poop.

**EW:** Um, fiber, talk to me about fiber and, yeah.

**EAU:** No,

**EW:** excuse me.

**EAU:** What do you wanna know? I'm gonna talk more next week about fiber.

**EW:** Okay. Okay. Okay.

**EAU:** What fiber does Yeah. On like a general level

**EW:** Sure.

**EAU:** Is it holds onto water.

**EW:** It holds onto water.

**EAU:** So fiber are parts of plant material that we cannot break down ourselves. Some parts of fiber, our gut bacteria can break down. Mm-hmm. And they do so, and when they do, then they usually produce gas. And so that's why sometimes fiber can make you real bloated and gassy.

**EW:** Yep.

**EAU:** Because your gut bacteria are so thrilled about it. Um, but other times they don't really break it down. And then all it is is this basically like large structure that holds onto water. And so because your colon is mostly just absorbing water, the more fiber that you have, the less water that you're absorbing from that.

**EW:** Okay.

**EAU:** So the softer your stool stays, it also PR provides this like bulking agent. Yeah. Which then your colon can perol against. And that is why it moves along as well too.

**EW:** Okay,

**EAU:** so that's basically fiber.

**EW:** I do have a question. I was thinking, okay, so, okay, so you talked about that the poop is our undigested or well, okay. The leftover flues, leftovers.

**EAU:** Yeah, yeah,

**EW:** yeah. Leftovers. And um, then it's also bacteria and some of our own gut microbes. Yeah. How much of it is gut microbes? What, what about our, our intestinal shedding? You know what, tell me about that stuff. I'm

**EAU:** so glad that you asked. That's the last thing I wanted to tell you. Oh

**EW:** my gosh.

**EAU:** It's like, we work so well together. So, 'cause that gets into like, okay, I said that it's just the leftover parts and now we know what our guts are doing the whole way down. But like, what really is our poop made out of? When you see a turd in the toilet, what is it really? Right?

**EW:** Well, it's on the stool scale of

**EAU:** something. On the stool scale.

**EW:** Yeah.

**EAU:** 75% of our poop is just water.

**EW:** 75%

**EAU:** on average. Okay. If we're talking like a bristle of three to five.

**EW:** Sure.

**EAU:** Okay. Um, the less, the more constipated, the harder the stool, the less water it's gonna have less water.

**EW:** Mm-hmm.

**EAU:** Um, but so 75% or so of it is usually water and the remaining 25% is like biomass. Up to 55% of that biomass is bacteria.

**EW:** Wow.

**EAU:** And up to 50% of that bacteria are still alive. Of those bacteria. Sorry for my grammar. So we're talking like, I also didn't even mention this, but like in your, in your colon especially, 'cause that's where we think about our gut microbiome the most. Yeah. Because that's where we have the most abundant flora. Even though we have microbes everywhere.

**EW:** Sure.

**EAU:** We are talking hundreds of billions if not trillions, of individual bacteria from hundreds if not thousands of different [00:30:00] species. All of which are doing different things. They're serving different roles, including helping break down the final bits of food that weren't broken down by our digestive tract. Mm-hmm. In our small intestine and our stomach, including making vitamin K and a number of B vitamins that are essential for us to then absorb in our colon. Um, and playing a huge role in our immune system, protecting us from infection with other bacteria. And then also just like modulating our immune response. And the more that we learn about our gut microbiome, the more. Like of a role that we know that it has in like our total body health. So when we're pooping out, like half of the actual mass of our poop is just bacteria.

**EW:** Yeah.

**EAU:** Which is also, that's, I

**EW:** can't get over that.

**EAU:** And it's also why our poop is so gross, because half of that bacteria is alive and could make you sick if it was the right type of bacteria or if it was opportunistic. And I can't wait for you to tell us more about that. And then the rest of it is fiber, insoluble, plant matter, uh, undigested sugars, undigested protein, whatever other stuff. And then some cells and mucus the rest of that 50%. And the breakdown depends on what you're eating, but. Erin, unless you have any other questions, I'm gonna transition to you.

**EW:** Okay. I mean, I just, okay. So there's so much bacteria. I, I just didn't, that's incredible. I know. Um, oh, I do have a question about just like water in general. Mm-hmm. So, you know, obviously we're drinking a lot of water. Yes. How does dehydration play a role in poop formation?

**EAU:** Huge role. Um, especially in constipation.

**EW:** Uhhuh,

**EAU:** so like the biggest, one of the biggest risks with diarrhea. Is that your colon is not absorbing that water.

**EW:** Yep.

**EAU:** And so you're at really high risk of dehydration. 'cause now you're losing one to two liters of water or more depending on how much you're pooping. Um,

and so that's a huge risk of diarrhea. And so if you are dehydrated, your colon is still going to absorb 90% or more of the water that is left in your colon. Okay. But if you are dehydrated to begin with, then you're not drinking as much water. There's not as much water making it there. And so that's why you're at risk of constipation.

**EW:** Got it. So,

**EAU:** yep. My second episode is now also done. Just kidding. So I'm gonna just end this by saying. If we think back again to what our poop is made out of, right?

**EW:** Yes.

**EAU:** It's bacteria, it's plant matter, it's fats and proteins. If you go even more nitty gritty on it, our poop is hydrogen and oxygen.

**EW:** Sure.

**EAU:** Water, carbon, nitrogen, especially from the bacteria and indigested protein. And then there's some amount of inorganic matter that we haven't used or that came from these cells like iron and calcium and phosphate. There's salts. So really Erin poop is just the building blocks of life.

**EW:** Uh, duh.

**EAU:** So tell me about how animals use it.

**EW:** Oh, I can't wait.

**EAU:** Great.

**EW:** I cannot wait. Okay. We have so many names for poop. I know so many names. There's excrement. Mm-hmm. Which comes from the Latin to separate or sift out,

**EAU:** okay?

**EW:** Mm-hmm. Turd. Love, I love turd. Love my, it comes from similar meanings.

**EAU:** Okay.

**EW:** Which I find interesting to split fla torn off the body.

**EAU:** Interesting

**EW:** crap. Uh, originates from the word for residue, specifically from rendered fat.

**EAU:** I love the word crap.

**EW:** I, I do too. I think turd is still, but like crap is more versatile,

**EAU:** right? Like, ah, crap.

**EW:** Yeah, exactly. I can

**EAU:** imagine my 2-year-old saying it and it just cracks me up.

**EW:** Uh, there's feces, which is from the Latin for sediment or drags, um, stool. I don't need to take us on that entomological journey. It's, it's longer, but it basically is like thrown is part of it, which I find fascinating. Like thrown

**EAU:** like

**EW:** a chair. It's like thrown like toilet. Yeah. Oh,

**EAU:** interesting.

**EW:** It's like, okay, fine. I'll take, I'll take us on this journey. It started as seat for one person. Oh. As in like throne. And then to the other stool that we think of today. You know, like the, just a stool. The stool. Like the little stool chair. Yeah. To then privy to then poop,

**EAU:** huh.

**EW:** Yeah.

**EAU:** Interesting.

**EW:** Um, d. Oh, manure. Um, poop. Do you wanna know where poop comes from? Yeah, it comes from the Okay. Does not come from poop deck, which I think is a common, like

**EAU:** swabbing the poop deck. Mm-hmm.

**EW:** Yep.

**EAU:** Those are not

**EW:** the same. Does not, not the same.

**EAU:** Oh,

**EW:** not the same. Um, etymological origin, I think. So poop probably comes from the middle English word. Uh, pooping, poppin referring to the sound a horn makes. Oh. Which then became fart. Fart. And then through Ana Pia became poop [00:35:00] pooping. Um, and then there are so many words that we use to describe animal poop. Mm-hmm. Droppings. Scat, which means any wild animal poop. Mm-hmm. Guano bat and bird poop.

**EAU:** Have

**EW:** some of that lunch. Yep. Bring out the guano.

**EAU:** This is some bat guano. Again. Thank you to the San Diego Natural Ha Museum. Um, we've got some carnivore poop. Some

**EW:** carnivore poop. Mm-hmm. At

**EAU:** that. It's so gross.

**EW:** It is. Yeah. Yep. That's carnivore poop. There's, um, frass, which is like insect waste. It's like poop. Yep. Poop. Yep. Sprint.

**EAU:** Oh, I haven't heard that.

**EW:** Otter poop specifically.

**EAU:** I'm sorry. I don't have an, uh, an example of

**EW:** that. I, I just was like, wait. So I was like, ot, stick

**EAU:** their own poop

**EW:** category. So, I don't know. I tried to look up other, like, species specific names for poop. Yeah. And I couldn't really find very many. I didn't do a huge search. I mean, just cubic poop. Okay. That's all really I know about that. I don't think that's, that's not the, it's not like a name that's not the name. Um, but perhaps the most versatile word for poop is SHIT. I know, I know. We

**EAU:** have a non explicit rating, so we're not gonna say

**EW:** the word, we're not gonna say it, but like such I do love. So it shares a similar kind of etymological origin as excrement and turd. It comes from this idea of separation from the body, which also means it shares an origin with the word science.

**EAU:** Really

**EW:** meaning to like separate one thing from another.

**EAU:** Huh.

**EW:** So

**EAU:** that's so interesting.

**EW:** Poop and science have the same, well, not poop, excrement and science have the same origin ish, actually. SHIT. But anyway, so, but like, yeah, SHIT has so many different, we can attach that word to like shoot the bull. Yeah. You know, um, chicken, whatever.

**EAU:** I love it.

**EW:** I blank my pants, that kind of thing. But there is no shortage of the ways to refer to the gut derived waste that we leave behind. But none of these words properly convey the respect and appreciation that poop truly deserves.

**EAU:** It's true.

**EW:** Even the word waste, which is one of our more like, you know, polite words. Mm-hmm. For poop means something of no use. Right. Something you don't want. Throw out something that you like. You're like, I don't need this. Yeah. Get it away from me. Can that be said for poop? I mean, as a species, we have devised massive, intricate sewer systems, true feats of engineering to increase the distance between us and poop feces. Poop elicits a feeling of disgust universally across all cultures, probably evolutionarily ingrained because avoidance of feces would also help to avoid disease. Right? So yes, not wanting to be around poop is reasonable. It's adaptive, but labeling it as waste really only tells one part of the story poop as a problem to deal with. Mm-hmm. And that's the story that I'm gonna tell more of next week. Okay. But this week my goal is to shine a more appreciative light. On this dark matter.

**EAU:** Dark matter. That's another good one.

**EW:** There's a book, I stole that from that. It's called *The Other Dark Matter*. Um, but because without poop and especially the creatures that repurpose it, our planet would be a vastly different place. Sure. A lifeless empty shell. So we have a lot to thank poop for. Yeah. And this is, we had a parasite appreciation hour at one point. This is the poop appreciation hour.

**EAU:** Oh, I love it. I'm here for it.

**EW:** Yes.

**EAU:** Let's appreciate some poop.

**EW:** Let's appreciate it. Okay, here we go. When I started traveling to Panama to do field work for my PhD, I picked up the book *Tropical Nature* by Adrian Forseth and Ken Miata. And by now I've forgotten most of what I learned in that book. But there was one piece of advice that has stuck with me. If you wanna see the forest come to life, watch what happens after you poop in the woods. Okay, I am reading a quote from this quote. Give it to me after nature calls. Do not beat a hasty embarrassed retreat, but sit quietly nearby. The earliest contestants will arrive soon after you settle down. First are the tiny dung, scab, beetles, and metallic titted flies. The later arrivals are larger and behaviorally more complex. Scab beetles. Upon landing, they embark on a series of maneuvers designed to secure a private cache of food that they will either eat themselves or barter for atory rights while the scarabs are carting away. Dung long, sleek staid beetles arrive on the scene. Agile and voracious. They burrow under the D mass in search of their prey. Of all the D deposited in tropical rainforest, human scat is the most avidly sought and the most quickly

removed. More than 50 species of D scarabs may converge on a pile of our manure before it is gone. 50 species. 50 species.

**EAU:** I don't even think I knew there were that many species of dung beetle.

**EW:** Oh, there are. Do I have it? We'll see.

**EAU:** [00:40:00] Lots,

**EW:** lots. Many more than 50 species. Isn't that great?

**EAU:** Yeah.

**EW:** I love that. That, so anyway, that is a piece of advice that I will also,

**EAU:** okay.

**EW:** Say do this. Do this. Do

**EAU:** poop in the woods.

**EW:** Do poop in the woods. Poop in the woods.

**EAU:** In the tropics specifically, like does it have to be tropics?

**EW:** No, there are poop. There are dung beetles on every continent except Antarctica. Wow. Yeah. They, I mean, they, they really are the unsung heroes Yeah. Of poop. I mean, in fact, all heroes of poop. Yeah. Including like the microbes and the fungi and the, they're just so cute. And they're so cute. They, they're all unsung, right? Yeah. Because no one really appreciates no dung beetles, what they do

**EAU:** for

**EW:** the

**EAU:** environment.

**EW:** Yeah. Because without them, we would be buried in the stuff because they take our waste product and they use it themselves, or they turn it into something

that other organisms like plants can use. Mm-hmm. Case in point. Australia in the years following European colonization.

**EAU:** Okay.

**EW:** Dung beetles are globally distributed, um, like I said, every continent except Antarctica, but they can be pretty picky about the poop that they utilize. Okay. When cattle were introduced to Australia by Europeans, the dung beetles there, which had evolved on a diet of marsupial poop, primarily.

**EAU:** Interesting.

**EW:** Were not interested in this new cattle dung.

**EAU:** Oh no.

**EW:** And the poop began to accumulate at a rate that approached 33 million tons per year.

**EAU:** Oh,

**EW:** just mounds.

**EAU:** It's like all honestly

**EW:** mounds, so much

**EAU:** poop that you can't, you

**EW:** can't imagine. I can't even visualize. Can

**EAU:** between million tons.

**EW:** Yeah. I'll talk a little bit about more other poop quantities. That there's better visualizations, but this one I don't have a good one for. Oh,

**EAU:** it's huge,

**EW:** huge, huge, uh, pest fly populations grew out of control and grazing land shrank because the cattle were like, I'm not gonna graze near these towering

piles of manure. That's gross. Gross. Yeah. And after about 180 years of this, the government decided they just couldn't take it anymore.

**EAU:** 180 years.

**EW:** I mean, that's like when the first cows were imported.

**EAU:** Okay. But still

**EW:** Yeah. The first fleet. Yeah. Um, so between, uh, between 1968 and 1982, in a move that I find shocking. Considering the issues that introduced species have caused in the past, guess what? Australia did,

**EAU:** introduced some dung beetles.

**EW:** He did 55 different species of D beetles, primarily from Southern Africa. I know. Risky, risky,

**EAU:** risky,

**EW:** but

**EAU:** But it paid off.

**EW:** It paid off.

**EAU:** Okay.

**EW:** About eight species took hold and since have been relatively successful in restoring some of the Australian pasture.

**EAU:** It's, that's so interesting. Erin, have we ever done an episode that's like just focused on the introduced species issues? We haven't. It's very outside of our, and yet inside of our personal interest.

**EW:** We should do that. Let's do fire ants. Okay.

**EAU:** Okay. All right.

**EW:** Done.

**EAU:** Done.

**EW:** But these dung beetles, I mean, it just showed how integral they are in the poop cycle. Yeah. And what valuable work they perform. So for about 15% of the Earth's ice-free surface is used for agriculture.

**EAU:** Okay.

**EW:** And that translates into a lot of livestock dung, much of which is handled by dung beetles and other decomposers in 2006. That's, that's like, it's a, it's 20 years ago, but you know what? It's fine. Dung beetle contributions to the US beef cattle industry alone, were estimated at \$380 million per year.

**EAU:** And no one's paying them.

**EW:** No one's paying them. They're getting paid in poop.

**EAU:** They're getting paid in poop.

**EW:** And they're happy about that.

**EAU:** They're thrilled.

**EW:** Yeah. By reintegrating dung into the landscape, dung beetles are helping to fertilize the soil. Mm-hmm. Cycle nutrients, distribute seeds, both reduce and distribute parasites, which have a role in ecosystems as well. We still

**EAU:** appreciate

**EW:** parasites. We love parasites. They're, they control pest fly populations. Some are even pollinators.

**EAU:** Really?

**EW:** Yeah. I don't know how, so don't ask.

**EAU:** That's fine.

**EW:** For the past 40 million years, dung beetles have been bringing new meaning to the phrase, one man's trash is another's treasure.

**EAU:** My God, I love it.

**EW:** Yeah. Over 5,000 species. There it is. I do have it. 5,000 species.

**EAU:** 5,000 species.

**EW:** I mean, it makes sense though because like think about niche differentiation like

**EAU:** I know, but just of dung beetle.

**EW:** Dung beetles.

**EAU:** Oh, insects are so cool.

**EW:** I know.

**EAU:** Okay.

**EW:** We are, oh, speaking of, um, if you are watching on YouTube, we have these sweet dung beetle shirts.

**EAU:** Shout out to uc, Davis and

**EW:** ology department ent. There are very, there are other cute shirts that we saw there too, but we just had to have these dung beetle shirts. We thank you. Yes, we did. For selling

**EAU:** them.

**EW:** Yes. But yeah. Among dung beetles, there are rollers that transport balls of dung to later bury under the soil. There are tunnelers, which bury the dung close to where it fell. Okay. There are dwellers which live in the poop or brew their young in the poop. In the poop. Mm-hmm. [00:45:00] And dung beetles are not innovators. Right. Like they, they didn't inherit a planet that was piled high with poop. They are carrying on a tradition that is foundational to life as we know it, whereby, quote unquote, waste is in the eye of the beholder. Mm-hmm. For the earliest microbes, oxygen. Was thought it was waste. Right. It was waste. It was a toxic byproduct. Yeah. Carbon dioxide was king and then came along the aerobic bacteria for whom oxygen was not just like weight. It wasn't just not waste, but it was essential. Essential, essential.

**EAU:** Oh, Erin, we're going deep dive.

**EW:** We're, I mean that's, that's like as deep as we're gonna go. Still. Just a little bit of a dive and then back up. Hi.

**EAU:** Love it.

**EW:** But what one organism produces as waste, another views as an opportunity. Mm-hmm. For us, we may view the poop that we produce as waste, and nothing more like, get this away from me. It stinks. It's gross. It's gonna make me sick. It's gonna make me sick. But for D beetles and flies and earthworms, and soil microbes and fungi, our poop is a rich substance packed full of nutrients. It's a place to raise your young, to make your mark, and to do your part to reuse and recycle.

**EAU:** I love imagining them like telling their kids this. Like, okay, kids, you get ready

**EW:** carry on the family biz. Yeah.

**EAU:** One kid is like, dad, can we just eat like broccoli and instead of, can I pollinate?

**EW:** Yeah. But we really don't give these organisms, these king Midas of the world, enough credit for transforming our waste into a pile of gold.

**EAU:** Yeah.

**EW:** That waste comes in all shapes and sizes from the cube shaped poop of a wombat. Mm-hmm. Uh, which is something to do. It's just the way that it,

**EAU:** they're colon

**EW:** their, yeah. Yeah.

**EAU:** Peristalsis

**EW:** to the kidney shaped D of a horse.

**EAU:** Oh,

**EW:** the pellets of rabbits.

**EAU:** I did not know that horse poop is shaped like a kidney.

**EW:** Mm-hmm.

**EAU:** Like a bean

**EW:** bean. Yeah.

**EAU:** Interesting

**EW:** beanie. Yeah. Uh, to the cylindrical tubes of carnivores

**EAU:** and us

**EW:** and us and omnivores. Yeah. Yeah, sure. I mean, I don't know if all omnivores have cylindrical poop.

**EAU:** Listen, me neither.

**EW:** There are generalizations that we can make, and there are exceptions to everything.

**EAU:** There's probably a Bristol stool scale for every animal. Just kidding. There isn't.

**EW:** Well, I was actually thinking that there probably should. Right? Like, there, there would be, there would be. Because a sick rabbit Right. Probably wouldn't produce

**EAU:** my dogs' poop ranges.

**EW:** Oh god.

**EAU:** In texture.

**EW:** Yeah. And I'm like, how am I supposed to get this off with the grass? It is just embedded instantly.

**EAU:** Especially the second or third poop of the wok. It's just like, ugh.

**EW:** You know when it's a third poop and you're just like, please don't,

**EAU:** there's

**EW:** no way to just please just, there's nothing. Just be

**EAU:** low grass, at least. Yeah. So you can wipe it.

**EW:** Ah, on second thought. I'm glad we don't have more pictures for this episode. It's a

**EAU:** good thing.

**EW:** But the variation in poop across the animal kingdom is so vast that you might wonder if there are any real common threads. Yeah. And it turns out that there are,

**EAU:** okay,

**EW:** so by modeling how different species pooped, some researchers concluded that the magic number for poop duration

**EAU:** is 12 seconds.

**EW:** Yes.

**EAU:** I found this paper, Erin, and I told my whole family about it. Did. And now my kid counts every time he goes to the bathroom and he's like, one, two. And I'm like, it's been more than 12 seconds, bro.

**EW:** I've been counting my dog. And I'm like, seven. Same. Are you? Okay? Same.

**EAU:** But it was 12 plus or minus seven seconds. That was the air. 12

**EW:** plus or minus seven seconds. I mean, okay. That's still like quite a small range. Range A of small range. Yeah.

**EAU:** Because it was like from elephants to rabbits or something.

**EW:** Oh yeah.

**EAU:** Give it to me here.

**EW:** So like, okay, elephants poop, 15 pounds a day.

**EAU:** 15 pounds. Pounds.

**EW:** Yeah.

**EAU:** Oh my gosh.

**EW:** Which is 100 times more than a dog poops.

**EAU:** Wow.

**EW:** Uh, elephants poop at a rate of three inches per second.

**EAU:** Keep going.

**EW:** Dogs poop at about a rate of 0.5 inches per second. Okay.

**EAU:** So it's a much smaller volume.

**EW:** It's a much smaller,

**EAU:** but same rate.

**EW:** Same rate. Like same, and humans are like just under an inch a second. Although are humans actually pooping 12 seconds? Absolutely not. We'll

**EAU:** talk more about

**EW:** it next week. We'll talk more about that next week.

**EAU:** Mm-hmm.

**EW:** But they're both like, how, how is an elephant pooping 15 pounds and a dog pooping? You know, like, how are they all pooping

**EAU:** the poop from like, the time that it exits the anus until the time it's done on the floor is 12 seconds. Plus or minus. Yeah. From an elephant to a dog,

**EW:** to a dog.

**EAU:** A chihuahua even.

**EW:** Yeah. How,

**EAU:** how

**EW:** the mucus.

**EAU:** The mucus.

**EW:** It is the mucus that lines our intestines. It keeps everything moving along, getting there, getting out there smoothly.

**EAU:** I, I just love this so much. I'm

**EW:** so glad that you also found it. 12 seconds.

**EAU:** Yes.

**EW:** Um, that's all I have for like the commonalities though for poop.

**EAU:** It's changed my life forever though.

**EW:** Me too.

**EAU:** Oh, we're gonna talk more about it next week. 12 seconds

**EW:** will come up again. 12 is the number, is is the magic number.

**EAU:** We should be able to poop in 12 seconds because we have cylindrical poops. Just like all of these mammals that they model.

**EW:** I mean, fiber. Is that the bottom line

**EAU:** paper was out of Georgia Tech for a second. I thought it was also out of Davis and I was gonna give them another shout out. Oh. But it was Georgia Tech.

**EW:** I don't know. I read it in [00:50:00] a book, so

**EAU:** I did too, but then I found the paper 'cause I was like, loved it so

**EW:** much. You feel like I need to know more. Uh, but yeah, as far as commonalities, like that's all I've got.

**EAU:** Fascinating.

**EW:** But the scent, the shape, the color, texture and location of poop, they vary so much across the animal kingdom and they can tell us about the animal that produced it and the kind of life that it is leading.

**EAU:** Okay.

**EW:** Right. So, uh, scent can tell us what the animal ate. Carnivore poop tends to smell much worse to us than herbivore poop

**EAU:** to us. Okay.

**EW:** Although scent is definitely again, in the nose of the beholder, right? Like

**EAU:** yes, yes.

**EW:** As anyone who has had a dog can attest uhhuh watching as their dog rolls in something unspeakably foul. So disgusting. Like, and I'm just like, why? Yeah. Why?

**EAU:** I still don't

**EW:** dunno. Why? Well, there's, there are a lot of reasons why actually. Okay. Uh, scent is a really powerful method of communication. Mm-hmm. So, for instance, it can alert a predator to prey species nearby. This is one reason why your dog might be rolling in poop. Just to be like, I'm not a, I'm not a prey. It's not

**EAU:** me. I'm not here.

**EW:** Yeah. Or like, I, I am a, you know, mighty predator. Smell my body, smell my, smell, my scent, my own feces. Yeah. Okay. Um, so it might be like a disguising of scent.

**EAU:** Okay.

**EW:** Uh, sharks apparently can recognize the poop of seals and humans and have may use it as a cue to like, oh, there's prey nearby certain sharks. Wow. Yeah.

**EAU:** I feel like you hear so much about how much sharks can sense blood, you know, like they can sense blood, but I never thought about them using poop as a That makes sense. Because it would just be, is floating in the

**EW:** right.

**EAU:** Interesting.

**EW:** And also poop would tell you more about the individual animal than blood.

**EAU:** Than just blood. Yeah.

**EW:** Right.

**EAU:** Blood is just blood.

**EW:** I mean, I'm sure blood is also a cue, but like,

**EAU:** yeah. Yeah.

**EW:** Poop. Interesting. Apparently too. Mm-hmm.

**EAU:** Mm-hmm. Juicy, juicy seal.

**EW:** Uh, yep.

**EAU:** Up ahead to the right.

**EW:** Take a left at the buoy. I don't know. Yeah. Some species bury their poop.

**EAU:** Mm-hmm.

**EW:** Or, uh, they shoot their poop in a projectile manner to throw predators off the trail. Butterflies do this called fresh shooting.

**EAU:** Oh my gosh.

**EW:** Yeah. Okay. Uh, the smell of poop can also signal to other members of your species, like, Hey, this is mine. This is my territory paw off.

**EAU:** Yeah. I feel like big cats do that.

**EW:** Um, hippo. Yeah. And also hippos. Do this big cats do this. Yeah.

**EAU:** Yeah.

**EW:** Okay. They'll, they, their tails will be like helicopters and they're like, PP poop, and it just like,

**EAU:** just

**EW:** shoots out getting their

**EAU:** poop all over

**EW:** their

**EAU:** little spot.

**EW:** Mm-hmm. Okay. Uh, some species have specialized glands that leave concentrated scents, like dogs. Dogs. They might even have other species have communal latrines where they all go poop. It's kind of like a very stinky message board. Like, Hey, what's everyone up to? Who's down to like party this weekend? Do

**EAU:** they hang out there or

**EW:** away? I don't think they hang out there. You can just poop and walk away. Yeah. Uh, certain infections might make poop have a distinctive smell, like a diff kind of warns like, Hey, this is. Bad poop. I'm not good. Yeah. I'm unwell. Don't roll in this. Mm-hmm. And for those species that have a keen sense of smell, poop is a rich source of information. And we humans have harnessed that power for our own data gathering.

**EAU:** What?

**EW:** Oh yeah. Tell me. So there are several researchers that have trained dogs to search for and alert to the poops of certain species to help with, like

estimating biodiversity or where animals are distributed in a region. Things like territory size, habitat preference, diet composition, and so on. It's hard for us to find poop.

**EAU:** Yeah.

**EW:** In a landscape. Right. But a dog is like, whew.

**EAU:** They know exactly where it's,

**EW:** yeah. You just gotta train 'em to not roll in it. So then, I'm assuming, I'm just kidding. They,

**EAU:** they use the dogs to find the poop and then they examine the poop.

**EW:** They'll look at the poop. Yeah. Yeah.

**EAU:** Oh, fascinating.

**EW:** Yeah. Yeah.

**EAU:** That's

**EW:** so

**EAU:** cool.

**EW:** There are even whale poop sniffing dogs.

**EAU:** Whale poop.

**EW:** Whale poop, sniffing dogs. Oh yeah. Whale poop is, I, I cut a huge, I, there was like a quote about the different like, uh, colors and shapes that whale poop can come in.

**EAU:** I've

**EW:** never thought about it, about poop. Oh yeah.

**EAU:** Do the, do the dogs sniff the whale poop on the, like when it washes up on the shore or?

**EW:** I think they're, they go on boats.

**EAU:** They go on boats and they can sniff it from the water

**EW:** uhhuh, I think. 'cause it's pretty diffuse. Like it'll just, and then what? Yeah. And like a plume.

**EAU:** Oh my God, I

**EW:** love thise

**EAU:** so much.

**EW:** And so there are some dogs that will like, I think it's orcas specifically, they'll, they'll like track individual whales to be like, okay, let's now test the water or test the poop and like, let's check their health.

**EAU:** Oh my God.

**EW:** I know.

**EAU:** That's so cool.

**EW:** I know, I know. And so we, we may not be able to smell as well as our canine companions, but once we get our hands on some poop, there is really like no end to what we can tell. So Erin, you took us through the Bristol School stool scale, but that's just one species, right? Consider the variation that you might find if you are tracking a bear, a black bear mm-hmm. Throughout, throughout the course of a year, right? Mm-hmm. Like where does that bear live? On the east, you know, in the east, in the, on the west, north or south. How does that influence its diet? Is it a cicada year? Is it living in a more urban environment and digging in trash? Yeah. Or is it just like total wilderness? Yeah. Is it eating huckleberries or blackberries fish or squirrels? [00:55:00] You know, like there's uh, is it an older bear or a baby bear there? Are there parasites? Is it stressed? I mean, poop is an informational pile of gold.

**EAU:** Yeah.

**EW:** Even if we don't know whose poop we've just stumbled upon on a hike in the woods, we can usually make some guesses based on its shape or its size. Carnivores tend to poop less than herbivores. Mm-hmm. Their scat often will

contain like hair or bones. And so if you see that you're like, oh, oh, carnivore. Yeah.

**EAU:** There's a little coyote

**EW:** poop. Yep. And it comes in a more cylindrical shape. Um, herbivores, on the other hand, poop way more and their poop tends to be floater with plant material. So that's carnivore. If you're, if you're tuning in on YouTube, we have

**EAU:** some

**EW:** carnivore poop,

**EAU:** some herbivore poop,

**EW:** some herbivore poop. So that's like mountain lion and rabbit right there. Rabbit. And, um, yeah, so like the herbi poop, it's like floater poop. There's plant material and the, the, it could vary from like sheep pellets

**EAU:** Okay.

**EW:** To cow pies and so on. Yeah. And it depends in part on how much moisture an animal retains. Of course,

**EAU:** of course, as we know.

**EW:** So for example, we think of these rabbit pellets as little hard balls, but rabbits also produce another type of poop that is softer and more nutrient dense. And we don't really see this type of poop because they produce it in their dens and they typically eat it,

**EAU:** no,

**EW:** straight away.

**EAU:** I knew you were gonna

**EW:** say that right From the source. Often they,

**EAU:** they eat it themselves.

**EW:** They eat it themselves. I mean, a lot of animals will eat their baby's poop too. And that's for a number of reasons. Part, it's like re extraction of nutrients. Okay. Um, and it's not just rabbits, it's a lot. Mice, uh, cows, termites sometimes, again, it's like nutrient reabsorption. Cows will tell you in a second. Um, it could be to conceal the poop of their offspring from predators. Okay. Or some researchers, especially when it comes to cows, think it might be a strategy to refresh the gut microbiota during a bout of intestinal disease.

**EAU:** Oh, that's

**EW:** so interesting. So like when cows are really showing like not good poop, they'll sometimes eat it to be like, do I need to get my, something like that.

**EAU:** That's so interesting. Like why would you wanna eat the poop? You would think like, let me eat my friend's poop. Right?

**EW:** Yeah.

**EAU:** If my friend's not pooping bad and I'm pooping bad, I'll eat my friend's poop.

**EW:** Yeah. Let's find the best cow pie here.

**EAU:** Maybe they have it figured out and

**EW:** make a little meal.

**EAU:** They poop their own. They eat their own

**EW:** poop. I think they eat their own. Yeah.

**EAU:** Gross.

**EW:** And before we turn up our noses at this, it's probably too late. Some of the most expensive coffee in the world is made from beans that have passed through the bowels of a palm civic.

**EAU:** C, have

**EW:** you heard of this civic poop? Coffee. Coffee, yeah. KPI Luo. It's the civic coffee. It's not the only prized poo product.

**EAU:** Okay.

**EW:** There's also,

**EAU:** okay.

**EW:** Amber Gris.

**EAU:** Amber gr. What is that?

**EW:** Oh, I'm so glad you asked. I am so glad you asked. I mean, I was gonna tell you anyway, but

**EAU:** Well tell me

**EW:** now. Thank you for asking. For over a thousand years, Amris has been one of the most valuable and sought after natural substances. What is it? It is a hardened mass of fecal material and undigested squid beaks that forms in the intestines and rectum of about 5% of sperm whales.

**EAU:** Sorry.

**EW:** Yeah. Lemme know if you need me to reread that.

**EAU:** Can you just so that I can really visualize

**EW:** Sure. Okay. Hardened mass.

**EAU:** Mm-hmm.

**EW:** Of fecal material

**EAU:** poop

**EW:** and undigested squid. Beaks. '

**EAU:** cause they're just chunks of, yeah. Mm-hmm.

**EW:** That forms in the intestines and rectum of about 5% of sperm whales.

**EAU:** 5%. So it's basically constipated sperm whale uh, rectal mass.

**EW:** Exactly.

**EAU:** And people eat this, or

**EW:** Oh, they do all kinds of things with it. Okay. So the reason that it like forms into a hard mass uhhuh. So of course sperm whales eat squids. Mm-hmm. Uh, the, they can't digest their beaks. And so usually they'll vomit the beaks up. That is the strategy

**EAU:** uhhuh,

**EW:** because whale poop is liquid. Ah. And if some get through all the way, it just gets stuck. It just gets stuck.

**EAU:** It's like a bezo.

**EW:** Exactly. Yeah. And so because the, um, the poop can, like the rectum can't relax enough to let the poop or to let the squid beaks through. And so then it just sort of forms and forms into these beaks will mold together form into this. So it really, mass it is constipated. It's, it's like a hardened ball of, huge chunk of hardened whale poop and squid beaks. And what happens, there's kind of two different schools of thought. One is that finally the rectum relaxes enough to let it out. The person whose book I read was like, I don't think that happens. I think that it. Bursts. And the whale dies.

**EAU:** The whale dies.

**EW:** Yeah.

**EAU:** So people aren't killing sperm whales to get this. I mean, I know they killed 'em for lots of things.

**EW:** There was, um, they would have, and they probably did for a while. So for a long time this was called, uh, floating gold because people were just finding it on the surfaces of the ocean. And they were like, this smells amazing. This is like, we could use this for everything. Uh, yeah. Listen, how

**EAU:** could it possibly smell?

**EW:** Oh, I mean, yeah. Uh, and [01:00:00] so, but then it was when whaling kind of picked up in the 17 hundreds, 18 hundreds, that people finally were like,

they would kill a whale and be like, oh my God, it's Aris. Can you believe it? So that's

**EAU:** where

**EW:** they figured out where it came from. Then they figured out. Yeah. So that's the finally it was like doing different theories, like, oh, I think it's what, I can't remember some of the other theories. Okay. What did they use it for? Erin? They used it for, um, medicine. A condiment, an aphrodisiac, and it is still today incorporated as a fixative and a musky scent in perfumes. Fixative meaning like it makes the smell, like the scent, like stay stronger. So it's still used today and it is, I mean, floating gold. So there was a chunk of Annenbergs found in 1914 that weighed 455 kilograms

**EAU:** who

**EW:** massive, massive. And it sold then in 1914 for 23,000 pounds, which in today's money is 3.4 million pounds, or four and a half million dollars. So that.

**EAU:** It's more than gold.

**EW:** It's more than gold actually. I don't know if that is, it's probably not gold yet. It's definitely not gold yet. So expensive

**EAU:** right now. Yeah. It's

**EW:** wild.

**EAU:** But, okay. Uh, this is, I am fascinated. I love this. If you, if we like checked on the back of like a perfume bottle and if it says Amber Gris on it, that means it's, it is, it is constipated sperm whale.

**EW:** I mean, I've never, I've never looked at a back of a perfume bottle. Me neither. And saw a list of ingredients. Yeah. But I think you would probably be able to find perfumes that contain Aris.

**EAU:** Fascinating.

**EW:** Do you wanna know what it smells like?

**EAU:** Yes.

**EW:** Okay. According to a new scientist article, it has a rich and complex odor consisting of fine tobacco, the wood of old churches, the smell of the tide, sandalwood, fresh earth and seaweed in the sun,

**EAU:** I believe seaweed, fresh tide, because let me tell you, I've smelled a lot of squid in my life.

**EW:** I, I want it to be fine tobacco in the wood of old churches, specifically

**EAU:** old churches. That's quite specific,

**EW:** right? What about an old church? You know, I

**EAU:** know there's some

**EW:** how old?

**EAU:** I don't, I don't have any answers.

**EW:** I don't, I don't either. I have no answers. I mean, I've, I'm left totally baffled still. Okay. ambergris and kopi luwak. Done. They may be treasured as poop novelties. Are you ready to move on from Amber gr forever? I

**EAU:** am gonna think

**EW:** about it. Are you ever gonna be ready forever? Good. 12 seconds in Amber gr this, but these two, they're not the only way that poop can be used. Okay. Poop can be used as fuel. Mm-hmm. As insulation, as insect repellent, as fertilizer, as building material as paper. One elephant can produce enough dung in one day to make 115 sheets of paper.

**EAU:** How do you make paper from poop?

**EW:** Fiber? From the undigested. Yeah.

**EAU:** Cool.

**EW:** Plant material. Yeah.

**EAU:** Are people doing that? Can I buy elephant poop paper?

**EW:** Uh, Google it.

**EAU:** Okay.

**EW:** Yeah. We'll, you know,

**EAU:** we will, after this

**EW:** we'll make some,

**EAU:** yeah.

**EW:** We can DNA Test it to determine the diet of an animal or catch a criminal. Ooh. This was done by matching DNA of dog feces at the scene of a crime to dog poop on the suspect's shoe.

**EAU:** Oh, fascinating.

**EW:** Isn't that wild? Yeah. I mean, talking about like

**EAU:** thinking

**EW:** outside the box,

**EAU:** be like, so they was coming from that dog, it was that same pile of poop.

**EW:** Yep.

**EAU:** On a

**EW:** shoe. Because they saw, like, I think in the crime scene photos, there was like a, yeah, like a smear, like the dog poop, smear, and then someone had it.

**EAU:** That's why you gotta clean your shoes.

**EW:** I mean, or just like not, you know, murder people, but Yeah. Well that too. You choose

**EAU:** both. And,

**EW:** but poop is so crucial ecologically in seed dispersal and parasite transmission. But the most important role of poop is in nutrient redistribution. Hmm. Critters like dung beetles that move and bury poop soil microbes that transform it into plant food. Animals like hippos and otters that live in water and on land and they move nutrients across those boundaries.

**EAU:** Oh, interesting.

**EW:** I

**EAU:** know. Yeah.

**EW:** Whales that feed at lower depth and then rise to poop and breathe, they redistribute, uh, nutrients across that depth. Oh man. Fish poop and whale poop that helps to offset ocean acidification. Like all of these are critical players in the poop nutrient cycle, but we humans are making it harder for them to do their work as a planet. We are producing more poop than we have ever before. Produce is produce, is that just '

**EAU:** cause we're more people?

**EW:** Uh, and more animals.

**EAU:** Livestock.

**EW:** Okay. More livestock. Yeah. And it's not even across the landscape. Mm. History has never seen the likes of the factory farming that exist throughout the world today. Okay. I'm gonna give you some numbers. Okay. So in 1961, there were approximately 400 million pigs, 940 million cows

**EAU:** around the world.

**EW:** Around the world,

**EAU:** okay.

**EW:** 1.3 billion sheep and goats.

**EAU:** Wow. Okay?

**EW:** And 3.9 billion chickens.

**EAU:** Okay.

**EW:** Just over 60 years later in 2023, okay? Which is the most recent data I could find. We are at [01:05:00] 1 billion pigs, which is more than double whoa. 1.6 billion cattle up from nine 40 million, 2.2 billion sheep and goats, and from 3.9 billion chickens in 1961. We're at 29 billion chickens.

**EAU:** And we wonder why bird flu

**EW:** We do. We wonder why bird flu? No, we don't. We know exactly why. Bird flu. Yeah.

**EAU:** Oh my god.

**EW:** Mm-hmm. And humans have more than doubled over that time from 3 billion to 8 billion.

**EAU:** But all of those numbers were like more than double.

**EW:** Oh yeah.

**EAU:** For the amount of humans.

**EW:** Yes. Yes.

**EAU:** Wow.

**EW:** Uh, each of us humans poops about 1% of our body weight a day.

**EAU:** Love this.

**EW:** So one of our entire selves, every few months.

**EAU:** Wow.

We poop our weight every few months

**EW:** each year. Domestic animals produce about 8 trillion pounds of poop. Which is 10,000 Empire State Buildings or 700 great pyramids of Giza.

**EAU:** I, you, you, you cannot, that's

**EW:** poop.

**EAU:** I can't, I cannot.

**EW:** That's poop. That's the best visualization. Because we can even still, how do we, how do, how do we envision, envision

**EAU:** that? How do 10,000, I can envision the single Empire State.

**EW:** I know

**EAU:** 10,000 of them. 10,000

**EW:** of them. That's

**EAU:** how

**EW:** much poop.

**EAU:** That's more than New York City worth of poop.

**EW:** Oh my gosh. Yeah. Oh, I think, oh, next episode. I have a New York City.

**EAU:** Okay,

**EW:** good poop statistic, but that excess poop, that incredible amount of poop that we are pooping now, it doesn't translate into more dung beetles and more nutrient dense soils. Like I mentioned at the top, dung beetles can be picky about the poo they use, but even those that like cattle poop are under threat because of the pesticides that livestock are treated with like ivermectin, which is then like excreted in their poop and is toxic to dung beetles. And so there are like. Dung beetle, they're like threatened dung beetles or depo like, uh, deforestation can also reduce dung beetle

**EAU:** population. 'cause they rely

**EW:** on

**EAU:** other things too.

**EW:** Exactly. Yeah. Um, and I'm singling out dung beetles because they're really charismatic. Mm-hmm. You know, our shirts like, you know, who else would want poop on a shirt? But this ripples far beyond dung beetle populations. Like we are facing a global poop catastrophe. Too much of it. And in all the wrong places.

**EAU:** Catastrophe.

**EW:** Pootastrophe, cacatastrophe. What we do. No, actually I like that.

**EAU:** Did you say cacatastrophe?

**EW:** Yeah.

**EAU:** A cacatastrophe. That's pretty funny.

**EW:** Thank you. Wow. Uh, um, but you know, in, in the past when poop has come up on this podcast, it's mostly been in the context of like public health. Right, right. Like that wrong place has been in our water or our food supplies. Yeah. But that's just one component. What about our farm runoff? Yeah. Our waterways, our pasture lands, leached of nutrients, and the poop just going down the river. Right? Yeah. And so I wanted to use these two episodes to approach poop from a different perspective mm-hmm. Than the typical public health one that we usually go with. It's one where we suspend our disgust and we consider what poop represents. Not as a waste, but as a hugely valuable substance. And hopefully today I have left you with a little bit more appreciation for crap. Yes. Or at least some fun facts to share. Yes. 12 seconds ambergris. And next week I'll go into how we attempted to solve our poop problem over the centuries and what the future of waste management might hold. And that's all I've got for you today on poop.

**EAU:** I love it.

**EW:** Except for sources.

**EAU:** Erin. That was so much fun.

**EW:** I'm glad

**EAU:** I wanted to

**EW:** keep going. I know. Well that's good 'cause we have another episode next week.

**EAU:** Perfect.

**EW:** Yay. Oh wow.

**EAU:** That was really good. We should tell everyone where they could read more. Though

**EW:** there is so much. I mean, narrowing down the narrative for poop was, it's

**EAU:** impossible.

**EW:** Ridiculous.

**EAU:** Yeah.

**EW:** And so there is so much more out there that you can read. Let me tell you. Okay. A few examples. So a couple of books, one by Joe Roman called Eat Poop Die. How Animals Make Our Worlds

**EAU:** Eat poop. Die Poop. I mean, what else do you do?

**EW:** And then another one, this is I think, my favorite title of a book that I've come across lately. So it's by David, uh, Walner Toes, the Origin of Feces.

**EAU:** The origin of feces.

**EW:** It's so good. That's good. It's good. Uh, and then there's a paper, uh, by Robert Clark, the Origin of Amber gr, and then by Nichols et al from 20, from 2008 Ecolo Ecological functions and ecosystem Services provided by scab Day Dung Beetles.

**EAU:** I love it.

**EW:** And more on the website.

**EAU:** My sources are not as much like fun 'cause I mostly used a textbook that was incredibly boring. Um, but shout out to the people who wrote it 'cause it was quite useful. It was called The Digestive System from Basic Sciences to

Clinical Practice. Um, I didn't read the whole thing, it was like 400 plus pages, but it's quite useful. So it was, especially if you want more about poop. Um, I also have a few different papers here. Uh, there's the characterization of feces in urine, a review of the literature to inform advanced treatment technology. I actually really loved that. It was a paper from [01:10:00] 2015 in critical reviews in Environmental Science and Technology by Rose Al. And then there was a paper that I, or a book that I only read part of.

**EW:** Okay.

**EAU:** But I really enjoyed the parts that I read, so I'm gonna give it a shout out. It was called Flush the Remarkable Science of An Unlikely Treasure. Did you read that book? No. It was a good, it was interesting.

**EW:** Wow. I, I looked up so many poop books.

**EAU:** I'm, I dunno how, so I came across this book. I love that. But I enjoyed the parts that I read, but there's a whole bunch more, um. Uh, there. Yeah, there's literally so many more. We'll post 'em all on our website. This podcast will kill you.com.

**EW:** Post them all. We'll, we will, um, thank you again to the provider of our firsthand account.

**EAU:** It's Thank I Can't express enough. Thank you. Oh my God, so much,

**EW:** so much

**EAU:** for sharing that story with us. I will cry laughing, thinking about it once again.

**EW:** Oh, yes, me too. Uh, thank you also to Blood Mobile for providing the music for this episode and all of our episodes.

**EAU:** Thank you to everyone and Exactly right, friend, everybody. Everyone, including everyone here today, and Tom and Leanna, and Brent and Pete and everybody who's involved in making this possible.

**EW:** It's amazing. And thank you to you listeners for listening and watching.

**EAU:** Yeah.

**EW:** However you partake in this podcast. We appreciate you. We

**EAU:** appreciate it. Please subscribe to the exactly right YouTube channel or us on the pod catchers that you like.

**EW:** Yeah,

**EAU:** we don't say that enough.

**EW:** We don't say that enough,

**EAU:** but it helps us. So thank you for doing it.

**EW:** We do say that a lot.

**EAU:** You're right. We do.

**EW:** Thank you also to our fantastic patrons. We really appreciate your support. You mean the world.

**EAU:** Yes,

**EW:** truly, truly.

**EAU:** Thank you.

**EW:** Yeah. Uh, until next time, wash your hands. You

**EAU:** filthy animals.